Jack (Xun) Cai

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Education

University of Toronto **2020 - 2025**
BASC. in Engineering Science with PEY co-op *cGPA 3.86 (90.4/100)*

University of Pennsylvania **2019**
Engineering Summary Academy at Penn - Biotechnology *GPA 4.0*

Relevant Coursework

- Ordinary Differential Equation 100%
- Computer Algorithms and Data Structure 97%
- Vector Calculus & Fluid Mechanics 96%
- Digital & Computer System
- Machine Learning (Online, Coursera)
- Deep Learning (Online, deeplearning.ai)
- Natural Language Processing (Online, deeplearning.ai)

Technical Skills

Languages: Python, Java, C/C++, MATLAB, Verilog, LaTeX
Tools/Frameworks: Linux, Git/GitHub, Docker, PostgreSQL, PyTorch, Tensorflow, Keras, Django, CI/CD, FPGA

Experience

Intelligent Sensory Microsystem Lab **January 2021 – Present**
Undergraduate Researcher *ECE, University of Toronto*

- **First authored** HyperLock, hardware security paper based on memristor crossbar neural network, on **IEEE ISCAS 2022**, the flagship conference of the IEEE Circuits and Systems Society.
- **Co-authored** paper on **brain graph learning with memristor crossbar hardware accelerator**.
- **Developed** circuit level memristor crossbar simulation framework with **PyTorch** for **graph convolutional neural network** and **graph convolutional neural ODE** to realistically simulate graph learning algorithms **on hardware**.
- **Derived and presented** vectorized adjoint sensitivity method for **graph convolutional neural ODE** on memristor crossbar, available *here*.

University of Toronto Machine Intelligence Student Team **September 2020 – June 2022**
Project Director (June '21 - June '22) *University of Toronto*

- **Directed** a team of **undergraduate and graduate** developers on the WallStreetBots project, try it *here*.
- **Lead the development** of an **online machine learning trading sandbox** with **Django** and **PostgreSQL**.
- **Prototyped** and **evaluated** natural language processing **transformer models** with **PyTorch**.
- **Researched** on integrating **Monte-Carlo portfolio balancing strategies** with **machine learning** model outputs.

Project developer (Aug '20 - May '21)

- Assisted the development of the **Humerus Bot project (AI to play Cards Against Humanity)** in **web scraping**, and **NLP** with **Bert**. Try the game *here* and view documentation *here*.
- **Applied Bert** model to generate **sentence embeddings** and classified them with **neural network** in **Tensorflow**.

University of Toronto Auto Drive Team **August 2021 – February 2022**
Simulation Team Member *University of Toronto*

- **Researched** noise modeling in self driving cars to achieve realistic simulations and implemented classical **non-ML approaches** (**Skellam**) and **ML approaches** (**GAN**)
- **Re-implemented** the **CycleGAN** model to self driving car simulation by applying **transfer learning**.

Other Projects

Roots: Decentralized Crowd-funding | *GCP, JavaScript, radar.io, React-Native, BlockStack* **April 2020**

- **UC Berkeley Hack:Now winner** for *Puma Browser* and *MLH: Best use of Blockstack*. For more detail visit *here*.
- **Built user mircro-transactions functionality** and **users authentication** through **Blockstack**.

Solar System Rocket Simulator | *C++, OpenGL* **December 2019**

- Rocket physics simulator based on Newtonian mechanic; try it *here*.
- **Independently** written in **C++** and rendered in **OpenGL**.

Leadership / Extracurricular / Award and Honours

NSERC USRA **May 2022 – August 2022**
Canadian National Research scholarship awarded to outstanding undergraduate students *University of Toronto*

ESROP-UofT **May 2021 – August 2021**
Summer Research scholarship awarded to outstanding undergraduate students in Engineering Science *University of Toronto*

Computer Science Club **September 2019 – June 2020**
President *Oakville Trafalgar High School*